

FACT SHEET

Proposed Issuance of Underground Injection Control (UIC) Area Permit AK-11003-A for the Construction and Operation of Class I Non-Hazardous Industrial Waste Injection Wells at the Alpine Oil and Gas Development of the Colville River Unit on the North Slope of Alaska

U.S. Environmental Protection Agency, Region 10
Ground Water Protection Unit, OW-137
1200 Sixth Avenue
Seattle, Washington 98101

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Introduction

ARCO Alaska, Inc. has submitted an Underground Injection Control (UIC) permit application for the construction and operation of up to three Class I non-hazardous industrial waste injection wells at the Alpine Field in the Colville River Unit on the North Slope of Alaska. The application was submitted to EPA on September 3, 1997, and additional information was sent to EPA on August 4, 1998. In response, EPA has prepared a draft permit for public review and comment. The public comment period will remain open until January 19, 1999, as described later in this fact sheet.

The 10-year term EPA permit would allow ARCO to inject all of the non-hazardous waste fluids generated at the Alpine Field into the naturally saline Ivishak and Sag River Formations at depths of about 8500 to 9500 feet below the land surface. This plan to inject non-hazardous waste fluids generated at Alpine is favored by EPA since it will minimize discharge to the land surface and surface water bodies, and will reduce the need to transport waste from this isolated field (located about 25 miles west of the Prudhoe Bay all-weather road network) to off-site treatment or disposal.

Public Comment

Peer review comments were sought from the Alaska Department of Environmental Conservation (ADEC) and the Alaska Oil and Gas Conservation Commission (AOGCC) in the development of the draft permit and this fact sheet. EPA is now requesting public comment prior to issuing the permit. Persons wishing to comment on the draft permit may do so in writing by January 19, 1999. All comments should include the name, address, and telephone number of the person making comment, a concise statement of the exact basis of any comment, and the relevant facts upon which it is based. All written comments and requests should be submitted to EPA at the above address to the Manager of the Ground Water Protection Unit or via electronic mail to partee.grover@epa.gov. After January 19, 1999, EPA may finalize the permit as drafted if no substantive comments are received during the public notice period.

Regulatory Framework

The Underground Injection Control (UIC) program is authorized by Part C of the Safe Drinking Water Act for the principal purpose of protecting Underground Sources of Drinking Water (USDWs) from contamination by injection through wells. The UIC regulations (see 40 CFR 144.3) broadly define USDWs as any aquifer capable of supplying a public water system with water of less than 10,000 milligrams per liter (mg/L) total dissolved solids (TDS).

Primary responsibility for regulation of injection wells through the UIC program is split in Alaska between EPA and the Alaska Oil and Gas Conservation Commission (AOGCC). The AOGCC has UIC program primacy for the regulation of Class II wells, and EPA directly regulates the other four classes of injection wells in Alaska. Class II wells are defined (see 40 CFR 144.6) as those wells used for injection in order to: 1) dispose of fluids brought to the surface from oil and gas production operations, 2) enhance the recovery of oil or natural gas, or 3) store liquid hydrocarbons underground. Class I non-hazardous industrial waste wells may be used to inject fluids eligible for Class II injection and any other non-hazardous waste. Therefore, ARCO is seeking to obtain a Class I non-hazardous waste injection well permit from EPA in order to inject all non-hazardous waste fluids generated at the site, regardless of whether or not the wastes are brought to the surface as part of the oil production process.

Underground injection needs to be conducted in a manner which ensures the protection of USDWs. However, based upon available information, EPA has determined that there are most likely not any aquifers beneath the permafrost in the Alpine field area which are fresh enough (less than 10,000 mg/L TDS) to qualify for protection as USDWs. Under these circumstances, the Director may authorize injection with less stringent requirements than would otherwise be required (see 40 CFR 144.16). EPA intends to grant several waivers requested by ARCO which are described under the Geologic Setting and Injection Issues portion of this fact sheet.

General Project Overview

The Alpine field area of the Colville River Unit is located about 60 miles west of Deadhorse, Alaska, and about 25 miles west of the westernmost part of the Prudhoe Bay all-weather road network. The isolated oil development will not be served by an all-weather road. ARCO has requested an area permit to allow the drilling, construction, and operation of up to three Class I non-hazardous industrial waste injection wells from the main facilities pad.

ARCO anticipates that the project will have a lifetime of 20 years. During this time, the Class I injection well(s) may be used to dispose of all non-hazardous waste generated at the project site. ARCO estimates that most of the fluid waste stream will be produced water generated after the field has been producing for about five years. Throughout the project life, the injection well(s) will be used to dispose of camp sewage and grey water, waste fluids intrinsically associated with oil and gas exploration and production, and a variety of non-hazardous industrial waste fluids generated onsite.

A general breakdown of the volumes to be injected over a 20-year period, as estimated by ARCO, are shown below:

<u>Type of Waste</u>	<u>Approximate Volume</u>
Produced Water (maximum case)	14,000,000 barrels
Well completion and workover fluids and solids, rig wash water, drilling mud, well flush water, process facility wastes, etc.	3,250,000
Camp sewage and other domestic wastewater	1,700,000
Non-hazardous industrial waste	50,000
TOTAL	19,000,000 barrels

Most of the waste to be injected will already be in liquid form and thus not require any slurring or other type of special handling. Wastes which will require some slurring include frac sand, vessel sludge, line pigging materials, pipe scale, incinerator ash, contaminated gravel, and (if necessary) drill cuttings. ARCO intends to dispose of most drill cuttings either through annular injection as part of the well construction process or through a dedicated Class II injection well, and both of those practices are regulated under permit by AOGCC. However, the Class I injection well to be permitted by EPA could also be used to dispose of drill cuttings if needed.

ARCO has not applied for a hazardous waste injection well permit. Therefore, any listed hazardous wastes will need to be collected, stored, and transported to a RCRA-permitted hazardous waste treatment or disposal facility. Those wastes which are hazardous only because of a characteristic (such as ignitability, corrosivity, toxicity, etc.) may be treated to remove that characteristic and then injected as a Class I non-hazardous waste fluid. The permit does not allow injection of radioactive wastes, as defined in the UIC regulations. Naturally occurring radioactive material (NORM) from sludge or pipe scale (a mineral precipitate formed during production) may be injected.

Geologic Setting and Injection Issues

The geologic setting at the Alpine field area is favorable for fluid waste disposal via injection wells. The stratigraphic sequence and lithology are correlative with the formations found at Prudhoe Bay, where Class II injection wells have operated successfully for almost two decades.

The proposed permit would allow injection into the Ivishak and Sag River Formations of Permian/Triassic age. The Ivishak Formation, which is the lower of the two, contains several porous (about 15%) and permeable (about 30 millidarcies) sandstone intervals which ARCO expects to encounter between about 8900 and 9600 feet below the land surface in the first disposal well. The uppermost sandstone of the Ivishak Formation is separated from the Sag River Formation by about 150 feet of shale and siltstone within the Ivishak, and roughly 300 feet of Shublik Formation limestone. The Sag River Formation is projected to be encountered at 8500 feet below the land surface. In the offsetting Nechelik well, the Sag River Formation is an approximately 50-foot thick interval of porous (about 19%) and permeable (about 120 millidarcies) sandstone.

ARCO estimates that the waste plume, if injected into a single well completed only in the Ivishak Formation, will extend radially around that wellbore almost 3400 feet. If both the Sag River and Ivishak are utilized, the waste plume is likely to extend radially about 2800 feet. Pressure effects from the proposed injection will extend beyond the fluid waste plume itself. Assuming that both the Ivishak and Sag River are utilized for injection, the reservoir pressure is anticipated to rise about 150 pounds per square inch (psi) at the wellbore, just under 100 psi a mile away, and just under 50 psi at a distance of seven miles. Given an original pressure of 4300 psi, these increases above background would be about 3.5%, 2.3%, and 1.2% respectively. These pressure increases are not expected to compromise the integrity of the overlying shale and siltstone confining zone.

The Sag River Formation, which would be the uppermost permitted injection interval, is separated from the overlying Nechelik tight oil zone and the Alpine field oil-producing horizon by about 900 feet of Jurassic age lower Kingak Formation shale and about 300 feet of Jurassic age upper Kingak Formation siltstone. The Kingak Formation will serve as the arresting and confining zone. Above the oil-producing stratigraphic horizon at Alpine lie more than 5000 feet of Cretaceous shale and siltstone, and about 800 feet of permafrost.

The strata at Alpine are almost horizontal, dipping about 1 to 2 degrees to the southwest, and are unfaulted above the proposed injection interval. Northwest-trending normal faults, which are interpreted to have as much as 50 feet of displacement within the Ivishak Formation, die out in the thick shale section of the lower Kingak Formation. Available evidence suggests that the faults do not naturally act as fluid conduits. Any preferential fluid movement along the faults which might occur during injection would likely be restricted to the Ivishak Formation itself.

Both the Ivishak and Sag River injection intervals are naturally saline. ARCO reports that water samples taken from flow tests were measured to have about 23,000 mg/L of TDS, or more than twice the 10,000 mg/L regulatory threshold used to define a USDW. Generally speaking, formation water salinity increases with depth, and so ARCO has used available information to estimate the quality of ground water found in aquifers above the injection intervals and below the permafrost.

Since no water samples have been taken above the oil-producing zone, these ground water quality estimates are based upon the analysis of geophysical borehole logs. These logs are records of the natural gamma radiation, density, and electrical conductivity of the rock and formation water measured before the borehole was cased. Review of these logs show that there are few clean (free from clay minerals or coal) sandstones within the stratigraphic section between the oil-producing horizon and base of the permafrost. Borehole log analysis of these few intervals suggests that they have formation water above the 10,000 mg/L TDS level which defines a USDW, and most of these few clean sandstones have formation water with an estimated TDS concentration of about 20,000 mg/L.

ARCO submitted information to support an aquifer exemption request in the event that EPA were to determine that some aquifers beneath the permafrost are fresh enough to qualify for protection as USDWs. This aquifer exemption request points out that ground water beneath the permafrost is not utilized as a drinking water supply anywhere on the North Slope, estimates the expense of extracting and treating the brackish to saline ground water for use as drinking water, and documents the availability of abundant fresh surface water resources which can be inexpensively treated for use as drinking water. In response, EPA has reviewed the geophysical borehole logs, ARCO's log analysis, the opinion of an AOGCC geologist with expertise in log analysis, and concluded that the available information suggests the few aquifers found beneath the permafrost at Alpine are too naturally saline to qualify as USDWs.

Since the proposed well(s) will not inject below a USDW, EPA may allow less stringent requirements for area of review, construction, mechanical integrity, operation, monitoring, and reporting than would otherwise be required by the UIC regulations (see 40 CFR 144.16). At the Alpine field, EPA intends to only relax some of the operating and monitoring requirements, as described below.

Compatibility of Formation and Injectant: Based upon the applicability of past injectability studies and injection practices at Prudhoe Bay and other North Slope fields, EPA intends to waive the requirements of 40 CFR 146.12(e) and 146.14(a) which require sampling and characterization of formation fluids and matrix in order to determine whether or not they are compatible with the proposed injectant.

Injection Zone Fracturing: Class I injection wells are prohibited from injecting at pressures which would initiate new fractures or propagate existing fractures within the injection zone. The draft permit instead allows hydraulic fracturing within the injection zone so long as new fractures are not initiated nor existing ones propagated within the upper confining zone.

Injection will be limited to the Ivishak and Sag River Formations. The uppermost injection interval (Sag River Formation) is about 8500 feet beneath the land surface, and approximately 1000 feet below the oil-producing horizon. The strata between the Sag River and the overlying oil-producing stratum is composed mostly of practically impermeable shale and siltstone.

Ambient Monitoring Above the Confining Zone: EPA intends to waive the requirement to monitor the strata overlying the confining zone for fluid movement (see 40 CFR 146.134). The principal purpose of this requirement is to protect overlying USDWs, which are not present at Alpine.

Summary of Proposed Action and Permit Conditions

EPA has primary enforcement authority in Alaska for Class I injection wells as they are regulated by the UIC program, which is authorized by Part C of the Safe Drinking Water Act. EPA grants Class I injection well permits to ensure that waste fluids are safely injected for disposal beneath any existing USDWs, and remain below the confining zone. EPA proposes to grant a permit to ARCO for up to three Class I non-hazardous waste injection wells at the Alpine field, located in the Colville River delta on the North Slope of Alaska. EPA has considered all of the available disposal options, and concludes that underground injection is the most appropriate way to dispose of non-hazardous fluid waste generated at the Alpine field.

Based upon available information, EPA has determined that there are no USDWs beneath the Alpine field area. Considering the absence of USDWs, EPA proposes to grant ARCO a waiver of the UIC program regulation which prohibits hydraulic fracturing of the injection zone during operation (40 CFR 146.13). This waiver is necessary to enable the injection of fluid wastes which contain a small fraction of solid material, and is authorized by the UIC program regulations under 40 CFR 144.16a.

The draft permit contains general legal provisions common to all EPA UIC program permits, specific technical requirements which apply to all Class I injection wells, and particular technical requirements for the proposed injection operation. EPA contacts for further information are Grover Partee at (206) 553-6697 or Jonathan Williams at (206) 553-1369.